

NATURAL RESOURCES CONSERVATION SERVICE CONSERVATION PRACTICE STANDARD

PIPELINE

(ft.)

CODE 516

DEFINITION

Pipeline having an inside diameter of eight inches or less.

PURPOSE

To convey water from a source of supply to points of use for livestock, wildlife, or recreation.

CONDITIONS WHERE PRACTICE APPLIES

Where it is desirable or necessary to convey water in a closed conduit from one point to another.

CRITERIA

Laws and Regulations. This practice must conform to all federal, state, and local laws and regulations. Laws and regulations of particular concern include those involving water rights, land use, land disturbed by construction, pollution control, property easements, wetlands, preservation of culture resources, and endangered species.

Livestock Water Distribution. Stock watering facilities should be located so the travel distance between forage and dependable water is not more than one mile in gentle relief or one-half mile in rough relief. Stock water facilities will not be planned at closer intervals than one-half mile on gentle relief or one-quarter mile on rough relief.

Capacity - Livestock Water. For livestock water, the installation shall provide the minimum capacity shown in Table 1.

On large extensive systems, peak use based on maximum flow from all outlets may not be needed. In these systems, capacity may be based on the maximum number of outlets used and livestock served at any one time.

Capacity – Domestic Use. System capacity must be adequate for all planned uses. Normal minimum design capacity shall be 10

gallons per minute (gpm) and 360 gallons per day per headquarters or dwelling unit.

For larger headquarters and for group systems with multiple users, use Tables 2 and 3.

Table 1 - Minimum Water Use Per Animal	
Animal	Water, Gallons/Day
Milking Cow	45
Dry Cow	30
Heifer	15
Calf (1.5 Gal./100 lb.)	10
Swine, Finishing	5
Nursery Pig	1
Sow with Litter	8
Gestating Sow	6
Horses and Beef Animals	12
East of Missouri River	20
West of Missouri River	2
	9
Sheep and Goats	15
100 Chicken Layers	
100 Turkeys	

Table 2 - Dwelling Minimum Water Supply	
Number of Dwellings	Minimum Gallons per Minute (gpm)
1	10
2	20
3	28
4	35
5	40
10	65
14	85

Table 3 Farmstead Equipment Minimum Water Supply	
Equipment	Minimum Gallons per Minute (gpm)
Automatic waterers Cattle, hogs, or sheep (20-40 head/bowl)	2
Poultry (100-150 layers)	1
Cleaning hose	10
Outdoor hydrant for uses other than firefighting	5
Firefighting hydrant	20

(Suggested reference: Midwest Plan Service Structures, Environment Handbook --MWPS-1)

Capacity – Recreation. System capacity shall be adequate for all planned uses. Typical examples are drinking water, fire protection, showers, flush toilets, and irrigation of landscaped areas.

Capacity – Wildlife. Additional capacity will be provided for requirements where applicable. Daily water consumption may be calculated at one gallon per day per 100 pounds of body weight, or specific amounts based on species if available.

Pipe Size. Minimum nominal pipe diameter shall be three-quarter inch. Where deposits in pipelines occur, minimum pipe diameter shall be one and one-half inch.

For design purposes, friction head losses shall be no less than those computed by using the following roughness coefficient:

Pipe Roughness Coefficient		
Pipe Type:	Steel/Iron	Thermos-plastic
Manning's N	0.012	
Hazen Williams C	110	0.009
		150

Sanitation Protection. If water from the pipeline is to be used for human consumption, applicable state and local regulations shall be met. Pipe conveying water for human consumption shall bear the National Sanitary Foundation Seal (NSF).

To prevent contamination or flow reversal on systems used for human consumption, double (or two single) spring-loaded check valves shall be used on all outlets or branch lines.

Pipe. All pipe fittings and appurtenances must withstand the pressures that will occur, including hydraulic transients, internal pressures, and external pressures. As a safety factor against surge or water hammer, the working pressure should not exceed 72 percent of the pressure rating of the pipe including any reductions for water temperature. For pipe installed above ground, minimum pipe pressure rating shall be 100 pounds per square inch. The design flow velocity at system capacity should not exceed five ft/sec for plastic and eight ft/sec for steel.

Steel pipe shall meet ASTM A53 or AWWA Specification C-200.

Plastic pipe shall meet ASTM D1785 or D2241 for polyvinyl chloride (PVC), and ASTM D2239 or D3035 for polyethylene (PE). Equivalent plastic pipe, solvents, rubber gaskets, and fittings conforming to other ASTM or AWWA specifications may also be used as appropriate.

Use of gasketed joints is preferred over solvent weld joints on thermoplastic pipelines one and one-half inch diameter and larger for increased thermal expansion capabilities.

Drainage. Valves or unions shall be installed at low points in the pipeline for systems installed above the frost line so that the line can be drained as needed. Check valves shall be installed as needed to protect groundwater quality or maintain a full pipeline.

Vents. Designs shall provide for entry and removal of air along the pipeline, as needed, to prevent air locking or pipe collapse. If parts of the line are above the hydraulic gradient, periodic use of an air pump may be required. Provisions shall be made for pressure relief, air relief, and vacuum relief as needed to protect the pipeline.

An air release valve or manually operated valve or hydrant shall be located on the first summit from the water source. Additional air release valves should be considered at summits in the line where an accumulation of air could cause reduction in flow. Additional venting is normally needed for artesian systems which contain gas, summits with extremely low operating heads, and summits

collecting air from multiple laterals or long reaches. Special care shall be taken in the pipeline layout to eliminate undulating grade changes.

Automatic vacuum relief valves may be needed at high points to prevent pipe collapse when drainage occurs in systems in steep terrain. These valves may also be needed to allow effective drainage of systems that will be drained to prevent freezing or for other purposes.

Other appurtenances. Check valves may be required in pipelines delivering water to points at higher elevations to prevent flow reversal.

Flow restrictor valves should be used in group pipelines where needed to control flow to outlets and prevent lower outlets and/or outlets closer to the source from causing periods of no flow or low pressure flow at higher outlets and/or outlets farther from the source.

Valves used to control flow may be smaller than the nominal size of the pipeline. Size shall be based on allowable velocity and headloss.

Suitable screens, strainers, or other protection should be considered to protect valves and other appurtenances that are prone to plugging.

Joints. Watertight joints that have a strength equal to that of the pipe shall be used. Couplings must be of material compatible with that of the pipe. If they are made of material susceptible to corrosion, provisions must be made to protect them.

Protection. When steel pipe is used, interior protective coatings shall meet Natural Resources Conservation Service (NRCS) Conservation Practice Standard 430FF, Irrigation Water Conveyance Steel Pipe. If a coal-tar enamel protective coating is needed for corrosion protection, the coating shall meet the requirements of AWWA Specification C-203.

Steel pipe installed above ground shall be galvanized or shall be protected with a suitable protective paint coating, including a primer coat and two or more final coats.

Plastic pipe installed above ground shall be resistant to ultraviolet light, or protection from sunlight must be provided.

All pipes shall be protected from hazards presented by traffic, farm operations, freezing temperatures, fire, thermal expansion, sharp rocks, other objects, and contraction. Reasonable measures should be taken to protect the pipe from potential vandalism.

Pipelines used for water supply during freezing weather must be installed below average frost line or protected from freezing using other methods.

Water Bars. Water bars (flow barriers) should be installed across the trench on long slopes or other locations where runoff water may cause erosion.

Vegetation. Disturbed areas shall be vegetated or otherwise stabilized as soon as practical after construction. Seedbed preparation, seeding, fertilizing, and mulching shall conform to NRCS Conservation Practice Standard 342, Critical Area Planting.

Visual resources. The visual design of pipelines and appurtenances in areas of high public visibility shall be carefully considered.

CONSIDERATIONS

Consider location of water supply outlets to avoid concentration of livestock near streams, lakes, and other areas needing protection.

PLANS AND SPECIFICATIONS

Plans and specifications for installing pipelines shall meet this standard and shall describe the requirements needed to achieve its intended purpose.

Engineering Field Handbook, Chapter 5, will guide the development of plans.

OPERATION AND MAINTENANCE

An operation and maintenance plan specific to the type of installed pipeline shall be provided to the landowner. The plan shall include, but not be limited to, the following provisions:

Opening/closing valves to prevent excessive water hammer;

Operation of manual air release valves or hydrants or other special equipment;

Requirements for filling at the specified rate;

Inspecting and testing valves, pressure regulators, pumps, switches, and other appurtenances;

Maintaining erosion protection at outlets;

Checking for debris, minerals, algae, and other materials which may restrict system flow; and

Draining and/or providing for cold weather operation of the system.

REFERENCES

Engineering Field Handbook

Unibell "Handbook of PVC Pipe"